

CHEMISTRY OF FOODS

The Family and Consumer Science academic standards for Chemistry of Foods support the course description, which can be found at <http://www.doe.in.gov/octe/facs/chemfo&nut.html>.

Standard 1

SCIENTIFIC AND SENSORY EVALUATION

- ___ CF.1.1 Demonstrate the functions of and proper techniques for using science equipment and food preparation equipment in the chemistry of foods laboratory.
- ___ CF.1.2 Employ the scientific method using appropriate laboratory methods, proper safety procedures, and accurate, objective data-recording techniques in the food science laboratory.
- ___ CF.1.3 Illustrate physical, psychological, cultural, and environmental influences on food preferences and their impact on nutritional wellness.
- ___ CF.1.4 Experiment with variables that influence sensory perceptions and taste preferences through laboratory taste tests of food products and food analogs.

Standard 2

BASIC CHEMISTRY OF FOOD

The Nature of Matter

- ___ CF.2.1 Depict the physical structure and components and the chemical properties of atoms, elements, the symbols on the periodic table commonly used in food science, electron transfer, ionic and covalent bond formation, and ionic and covalent compounds.
- ___ CF.2.2 Demonstrate ability to differentiate between pure substances, solutions, and heterogeneous mixtures based on physical properties such as density, melting point, boiling point, and solubility.
- ___ CF.2.3 Demonstrate physical and chemical reactions in food products in scientific laboratory experiments.
- ___ CF.2.4 Balance chemical equations to illustrate simple chemical reactions.

Energy: Matter in Motion

- ___ CF.2.5 Differentiate among potential and kinetic sources as well as the various forms of energy.
- ___ CF.2.6 Explain heat of fusion, heat of vaporization, and the relationship between heat and temperature.
- ___ CF.2.7 Explain the role of energy in metabolism and digestion.

Ions: Charged Particles in Solution

- ___ CF.2.8 Calculate atomic mass and molarity levels for various solutions and evaluate taste preferences for various molarity levels in particular foods or food products.
- ___ CF.2.9 Characterize acids and bases and demonstrate the role of pH in food preservation, baking, other food preparation applications, and in digestion and blood.

Water: The Universal Solvent

- ___ CF.2.10 Describe how the polar structure of a water molecule affects water's physical characteristics.
- ___ CF.2.11 Explain the ways water content of foods affects food reactions during preparation and storage processes.
- ___ CF.2.12 Explain four functions of water in the body and the role of water in a nutritious diet.

Standard 3

ORGANIC CHEMISTRY

Simple and Complex Carbohydrates

- ___ CF.3.1 Summarize the process of carbohydrate production through the process of photosynthesis.

- ___ CF.3.2 Describe the monosaccharides that form each of the disaccharides and how they are combined to form those disaccharides.
- ___ CF.3.3 Explain the chemical process and the products of hydrolysis of sucrose and lactose.
- ___ CF.3.4 Explain the characteristics and functions of the four categories of complex carbohydrates (starches, cellulose, gums, and pectins) in food preparation.
- ___ CF.3.5 Evaluate the five physical properties of starch and liquid mixtures and their impact on the selection of starches to be used in food products.
- ___ CF.3.6 Compare the advantages and disadvantages of the three main methods used to add starches to sauces.
- ___ CF.3.7 Demonstrate the role of simple and complex carbohydrates in a nutritious diet.

Lipids: Nature's Flavor Enhancers

- ___ CF.3.8 Relate physical characteristics and dietary sources of saturated, monounsaturated, and polyunsaturated fatty acids to their performance in foods.
- ___ CF.3.9 Demonstrate the molecular structure of glycerides, phospholipids, and sterols and their functions in food preparation.
- ___ CF.3.10 Explain the nutritional impact of lipids in the diet and in control of heart disease.

Proteins: Amino Acids and Peptides

- ___ CF.3.11 Explain the amino acid classification system based on nutritional use and relationship of chemical properties of elements and side chains.
- ___ CF.3.12 Describe the primary, secondary and tertiary structures of proteins, at least six factors that denature proteins, and the functions of protein in food production.
- ___ CF.3.13 Utilize basic principles of the chemistry of protein to methods of selection, storage, and preparation for eggs, milk products, and meat products.
- ___ CF.3.14 Compare the nutritional functions of proteins with the functions of carbohydrates and fats.

Enzymes: The Protein Catalyst

- ___ CF.3.15 Explain the relationship between a substrate and an active site, the role of coenzymes in enzymatic reactions, and other factors that affect enzymatic activity.
- ___ CF.3.16 Explain how some foods are developed as a result of enzymatic activity.
- ___ CF.3.17 Compare the effectiveness of five methods of preventing enzymatic browning.
- ___ CF.3.18 Describe and depict the effects of heat and other factors on foods that contain proteolytic enzymes and on their interaction with protein gels.

Standard 4

FOOD CHEMISTRY: THE MICROCOMPONENTS

Micronutrients: Vitamins and Minerals

- ___ CF.4.1 Explain the sources and functions of fat-soluble vitamins, water-soluble vitamins, major minerals, and trace minerals impact food processing and preservation methods have on the nutritive value of food and management of food-related disease.
- ___ CF.4.2 Demonstrate techniques to reduce vitamin and mineral losses during food distribution, storage, and preparation.

Phytochemicals

- ___ CF.4.3 Describe at least eight groups of phytochemicals, food sources for each group, and their role in disease prevention.
- ___ CF.4.4 Calculate the effects of acids, bases, heat, and mechanical processes on phytochemicals in fruits, vegetables, and dairy products.

Food Analogs and Food Additives

- ___ CF.4.5 Compare the functions of food analogs and food additives and the advantages and disadvantages they provide for the food supply.
- ___ CF.4.6 Describe a variety of food additives and analogs and their effects on flavor, texture, appearance, and nutritive value of a variety of foods.

Standard 5

FOOD MICROBIOLOGY: LIVING ORGANISMS IN FOOD

Fermentation: Desirable Effects of Microbes

- ___ CF.5.1 Describe factors that impact fermentation of yeast, bacterial, and mold.
- ___ CF.5.2 Illustrate the production or formation of food products that are a result of fermentation and other leavening agents.

Food Safety: Sources of Contamination

- ___ CF.5.3 Differentiate among the types of pathogens and other food contaminants and foodborne illnesses.
- ___ CF.5.4 Demonstrate food distribution and handling procedures that prevent or reduce entry of pathogens into the food supply and the growth of illness-causing microbes.
- ___ CF.5.5 Describe methods for identifying and controlling sources of contamination of foods and the food supply.

Standard 6

BIOTECHNOLOGY IN FOOD PRESERVATION AND PACKAGING

Thermal Preservation: Hot and Cold Processing

- ___ CF.6.1 Compare the effects of various thermal preservation methods on texture, flavor, appearance, and nutritive value of fruits, vegetables, beverages, other foods, and food products.
- ___ CF.6.2 Contrast the variables that must be controlled to maintain quality in various methods used for commercial and residential preservation of foods and food products.

Dehydration and Concentration: Controlling Water Activity

- ___ CF.6.3 Demonstrate the effects of various methods of commercial and home dehydration on the quality of texture, flavor, appearance, and nutritive value of dried foods, food concentrates, and dehydrated food products.

Trends in Food Preservation: Irradiation, Packaging, and Biotechnology

- ___ CF.6.4 Illustrate the effectiveness of irradiation, light exposure, and variations in temperature and humidity on bacteria growth, oxidative rancidity, and other spoilage indicators.
- ___ CF.6.5 Describe and depict the effects of food irradiation, reduced oxygen packaging, and other food packaging methods on the texture, flavor, appearance, and nutritive value of food products.
- ___ CF.6.6 Illustrate impacts of advances in biotechnology and their applications in the food industry.

Standard 7

COMPLEX FOOD SYSTEMS

Mixtures: Solutions, Colloidal Dispersions, and Suspensions

- ___ CF.7.1 Demonstrate the effects of temperature, chemical reactants, and mechanical processes on mixtures, including solutions, colloidal dispersions, and suspensions.
- ___ CF.7.2 Illustrate the characteristics of colloids and solutes, common types of food emulsions, and properties of suspensions using food and food products as examples.

Separation Techniques: Mechanical and Chemical Methods

- ___ CF.7.3 Compare and contrast mechanical and chemical methods of sorting or separating foods and food components.

- ___ CF.7.4 Explain how the principle of osmosis is used to separate food components at the macro-molecular level and the impact this has on metabolism.
- ___ CF.7.5 Compare osmosis in food products with digestion and metabolism of food components in the human body.

Research: Developing New Food Products

- ___ CF.7.6 Contrast descriptive research and analytical research.
- ___ CF.7.7 Employ the scientific method to develop food science experiments, including at least one control and one variable, that examine one of the characteristics of a complex food system.
- ___ CF.7.8 Demonstrate synthesis of research findings to develop and test a formulation for a new, nutritious food product or new variation of a food product.

Standard 8

HISTORICAL AND CAREER PERSPECTIVES

- ___ CF.8.1 Describe major occurrences in the three historical periods in the development of foods.
- ___ CF.8.2 Summarize the ways food products and processing methods have changed in modern history due to contributions of food scientists.
- ___ CF.8.3 Illustrate with a time line the milestones in government regulation of food, food processing, food products, and food packaging.
- ___ CF.8.4 Analyze personal qualities and training needed, working conditions, employment outlook, and career opportunities related to food science, food service, and dietetics in business, education, and government.